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ABSTRACT

Seattle University recently decided to replace three separate, computerized student-information systems with a single, integrated system. The complexity of this decision was managed with a multicriteria method that was used to evaluate alternative systems. The method took into account the many and sometimes conflicting concerns of the people who would use whatever system was finally selected. Multicriteria analysis not only provided a way of managing a large amount of information, but apparently reduced people's resistance to change. The method and its application to this particular computer system selection decision is described, and a chart of criteria and ratings is provided. The method, which is simple in structure, is seen as adaptable to different kinds of decisions and decision-making processes encountered by institutional researchers. Contains 5 references. (Author/KM)

# Multicriteria Analysis: Managing Complexity in Selecting a Student-Information System

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Teresa Karolewski
Chair and Editor
Forum Publications Editorial
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## Abstract

Seattle University recently decided to replace three separate, computerized student-information systems with a single, integrated system. The complexity of this decision was managed with a multicriteria method which was used to evaluate alternative systems. The method took into account the many and sometimes conflicting concerns of the people who would use whatever system was finally selected. Multicriteria analysis not only provided a way of managing a large amount of information, but apparently reduced people's resistance to change. The method is simple in structure and can be adapted to different kinds of decisions and decision-making processes encountered by institutional researchers.

## Introduction

The purpose of this paper is to demonstrate how an easy-to-understand multicriteria method can be used to manage a large amount of information about the consequences of alternative courses of action. We illustrate how the method was used to aid in making a complex decision at Seattle University: the selection of a computerized student-information system. The method, however, can be used to assess the relative attractiveness of alternative ways of accomplishing virtually any specified ends. We do not discuss the relative merits of various computerized student-information systems. Our focus is on the method of assessment and how the method facilitated the decision-making process.

To begin, we present the background of the decision situation, then explain the multicriteria method that was used to aid in reaching a decision, and finally discuss the validity of the method as a decision-aiding tool.

## Background

In the fall of 1986, an implementation task force at Seattle University (SU) had been working for a year to phase in a computerized student-information system called ISIS (Integrated Student Information System). ISIS was to replace independent systems in the offices of admissions, financial aid, the registrar, and the controller. Collectively, the members of the task force represented all of the SU staff members who would

eventually be using ISIS. After a year's preparation to phase in ISIS and phase out the various existing systems, members of the task force began to question if ISIS would be able to perform all necessary functions adequately. The foremost areas of concern were: (1) What student-service policies would have to be changed to make ISIS work? (2) How many hours of software modification would be required? and (3) Would important capabilities of the existing systems be lost, such as:

- Ad hoc reporting?
- Independence from data-processing personnel for routine operations?
- Flexibility in building and maintaining displays of student data?
- On-line inquiry about individual students?
- Production of enrollment statistics on-line?
- Production of letters and selection of mailing labels?

In addition to the above, other concerns arose:

- The scope and cost of the modifications to be made to ISIS were greater than anticipated;
- The original implementation schedule could not be met; and
- The process that was being used to develop and review modifications to ISIS was creating conflict between ISIS users and the programmers who would maintain and modify ISIS.

Because of these concerns, SU's Cabinet (the president and vice presidents) authorized the formation of the ISIS Study

Group (ISG) to reevaluate the wisdom of replacing functioning information systems with ISIS. The authors of this paper and one other person were the members of the ISG.

The ISG's first task was to examine the process that had led to the decision to purchase the ISIS system and had guided the work of the ISIS-implementation task force during the preceding year. The ISG understood its role to include allowing SU's computer users opportunities to express their concerns about the adequacy of ISIS and to suggest alternatives. To facilitate communication between the ISG and computer users, an ad hoc advisory group was formed. This group included the already constituted ISIS-implementation task force and the member of SU's Administrative Computer Users Committee, an advisory committee to the department of Computer and Information Services. This committee is made up of representatives of all administrative users. Potential users from the academic ranks were also asked to serve, including the deans and a representative from the Faculty Senate. In all, the Ad Hoc Advisory Group had 25 members.

The ISIS Study Group began its work by reviewing the reports and memoranda that had led to the decision to replace existing systems with ISIS. The ISG summarized its findings in statements of fact. These summaries, along with the documents themselves, were sent to members of the Ad Hoc Advisory Group for their review and comment. This process allowed the ISG to focus on the concerns about ISIS and develop evaluation criteria based on

these concerns. These criteria were then used to evaluate three alternative courses of action, which are described in the next section. The ISG had also considered several other student-information systems but found them to be too big or too small for SU or incompatible with the hardware SU had available. And purchasing new hardware was not financially feasible.

## Description of Alternatives

Three alternatives for meeting SU's student-information requirements were selected for evaluation:

(1) Continue using all currently functioning student-information systems--four independent systems serving the offices of admissions, financial aid, the registrar, and the controller. All of these systems ran on SU's Hewlett-Packard (HP) computer.

(2) Install ISIS with the modifications that had already been made or had been approved by SU's Cabinet. This version of ISIS would run on SU's newly purchased IBM computer.

(3) Install ISIS with all the modifications that had been recommended six months earlier by the ISIS-implementation task force. (The task force had recommended many more hours of modification than had been approved by the Cabinet at that point.) This version of ISIS would also run on SU's newly purchased IBM computer.

## Evaluating the Alternatives

To evaluate the relative adequacy of the three alternative information systems, the ISG specified measurable criteria on a draft of the evaluation form that was eventually used. These criteria emanated from the users' concerns. Computer users from the offices of admissions, financial aid, housing, the registrar, and the controller were then asked to review all the criteria, weigh the importance of each criterion, and rate the alternatives on the criteria that related to their concerns. The rating scales used on the evaluation form are simple (see Figure 1). For example, the degree to which various functional requirements were judged to be met by a particular alternative is rated on a three point scale: 1=does not meet, 2=meets minimum, and 3=exceeds. This and the other simple scales on the evaluation form made sense to the users because the users were well familiar with all three alternatives.

The ISG assigned weights to the criteria based on a composite of the weights suggested by the individual users, then scored each alternative on each criterion. Decisions about weights and scores were reached by consensus after ISG members sought clarification from each other and, in several cases, after they consulted users.

To derive total scores for alternatives, numerical scores were assigned to each alternative on each criterion. Then scores for each criterion were multiplied by the assigned weight for that criterion. Finally, weighted scores for each alternative were summed. ISIS with all requested modifications received the highest

Evaluation Criteria

The weight (relative importance) of each criterion appears in parentheses: low=1, medium=2, high=3.

| | Rating Scales | | | | Alternatives | | |
|---|---|---|---|---|---|---|---|
| 1. Degree to which meets functional requirements for: | Does Not Meet | Meets Minimum | Exceeds | Weight | Existing HP System | ISIS with Modifications Made or Approved | ISIS with All Requested Modifications |
| a. Course catalogs (course master in HP) | 1 | 2 | 3 | (3) | | | |
| b. Class schedule | 1 | 2 | 3 | (3) | | | |
| c. Recruitment/admissions | 1 | 2 | 3 | (3) | | | |
| d. Financial aid--INAS/PARS | 1 | 2 | 3 | (3) | | | |
| e. Financial-aid awards | 1 | 2 | 3 | (3) | | | |
| f. Student demographics | 1 | 2 | 3 | (3) | | | |
| g. Enrollment | 1 | 2 | 3 | (3) | | | |
| h. Housing | 1 | 2 | 3 | (2) | | | |
| i. Accounts receivable | 1 | 2 | 3 | (3) | | | |
| j. Grades/academic history | 1 | 2 | 3 | (3) | | | |
| k. Degree audit | 1 | 2 | 3 | (3) | | | |
| l. Graduation tracking | 1 | 2 | 3 | (3) | | | |
| m. Selection and production of labels | 1 | 2 | 3 | (3) | | | |
| n. Flexibility of selection and production of letters | 1 | 2 | 3 | (3) | | | |
| o. Assessment of fees | 1 | 2 | 3 | (3) | | | |
| p. Term structure | 1 | 2 | 3 | (3) | | | |
| q. Student ID | 1 | 2 | 3 | (3) | | | |
| r. Ad hoc reporting | 1 | 2 | 3 | (3) | | | |
| 2. Degree to which software is user friendly: | Low | Medium | High | | | | |
| a. Adequacy of screen design | 1 | 2 | 3 | (3) | | | |
| b. Ease of data entry/correction | 1 | 2 | 3 | (3) | | | |
| c. Ease of sign-on and sign-off | 1 | 2 | 3 | (1) | | | |



re 7. Multicriteria evaluation form

| | | | | | Existing HP System | ISIS With Modifications Made or Approved | ISIS With All Requested Modifications |
|---|---|---|---|---|---|---|---|
| 3. | Degree to which software is flexible: | Low | Medium | High | Weight | | |
| | a. Ability to adapt systems tables | 1 | 2 | 3 | (3) | | |
| | b. Degree of departmental-level security | 1 | 2 | 3 | (3) | | |
| | c. Degree to which allows user initiation of reports | 1 | 2 | 3 | (3) | | |
| 4. | Degree of compatibility of printed output with existing printed output: | Not Compatible | Awkward | Compatible | | | |
| | a. Format of transcripts | 1 | 2 | 3 | (3) | | |
| | b. Report dimensions | 1 | 2 | 3 | (2) | | |
| | c. Report design | 1 | 2 | 3 | (3) | | |
| 5. | Degree to which software is compatible with current SU student-services policies | Low 1 | Medium 2 | High 3 | (3) | | |
| 6. | Degree of availability to user population | Inadequate 1 | Adequate 2 | Superior 3 | (3) | | |
| 7. | Affect on morale | Negative 1 | Neutral 2 | Positive 3 | (3) | | |
| 8. | Degree to which normal operations will be disrupted | A Little 3 | Some 2 | A Lot 1 | (2) | | |
| 9. | Degree to which staff workload will be increased | A Little 3 | Some 2 | A Lot 1 | (3) | | |
| 10. | Degree of additional training required | A Little 3 | Some 2 | A Lot 1 | (2) | | |
| 11. | Availability of current and future computer systems: | A Little | Some | A Lot | | | |
| | a. Are programmer-productivity tools available? | 1 | 2 | 3 | (2) | | |
| | b. Are user-query tools available? | 1 | 2 | 3 | (2) | | |
| | c. Are the hardware and systems software commonly used in higher education? | 1 | 2 | 3 | (1) | | |
| | d. Is the hardware/software environment served by several higher-education software vendors? | 1 | 2 | 3 | (1) | | |

Figure 1. (continued)

| | Low | Medium | High | Weight | Existing HP System | ISIS With Modifications Made or Approved | ISIS With All Requested Modifications |
|---|---|---|---|---|---|---|---|
| e. Will new hardware and systems software be available? | 1 | 2 | 3 | (3) | | | |
| 12. Degree to which meets technical standards: | Low | Medium | High | | | | |
| a. Is documented--user, programmer, operations | 1 | 2 | 3 | (3) | | | |
| b. Uses programming standards | 1 | 2 | 3 | (2) | | | |
| c. Is easily modified | 1 | 2 | 3 | (3) | | | |
| d. Uses a proven data-base management system | No 1 | Yes 2 | | (2) | | | |
| 13. Degree to which meets data standards: | Low | Medium | High | | | | |
| a. Ease of integration | 1 | 2 | 3 | (3) | | | |
| b. Provides audit trails of activity | 1 | 2 | 3 | (3) | | | |
| Total of Weighted Scores | | | | | _____ | _____ | _____ |

Instructions:

Score the alternatives on all criteria.

Complete evaluation of alternatives by multiplying the weight (relative importance) of each criterion times the score assigned to each alternative on each criterion. Then sum the weighted scores for each alternative over all criteria.





Figure 1. (continued)

score and the existing HP system received the lowest. We will not, however, elaborate further on the ratings assigned to the alternatives, since our purpose is to describe the evaluation process, not to support one of the alternatives.

When the ISG completed the evaluation form with weights, ratings, and total scores for the alternatives, the ISIS Ad Hoc Advisory Group was called together to review and discuss the results of the ISG's numerical evaluation. Presentation of the results on the evaluation form allowed a large number of people with different concerns and perspectives to focus on a complex body of information. Further, the multicriteria method allowed everyone a chance to see that his or her concerns were explicitly taken into account in evaluating the alternatives.

Results of the ISG's systematic and comprehensive evaluation pointed to ISIS with all modifications as the preferable alternative. During the discussion of these results, users' objections to replacing existing systems with ISIS seemed to dissolve. Consequently, SU administrators decided to install ISIS with most of the modifications requested by the implementation task force.

## Validity of the Method

While the specific alternative selected was certainly important to the people at SU, our purpose is not to focus on the merits of the alternative selected but on the method used to facilitate the decision-making process.

The criteria the ISG developed reflected the concerns and judgments of the particular set of actors at SU. Similar concerns might exist at another university with different actors, but it's not likely these concerns would be identical to the concerns at SU. The value of the method, then, is not in its ability to identify the optimal choice in an objective sense. The value of the method is in the structure it provides for weighing a large number of complex and interrelated concerns. Multicriteria analysis allows the comprehensive, balanced consideration of the many issues that arise in making complex decisions.

The method we used is not new, but an adaptation of a class of methods well documented in the evaluation literature in the field of urban planning. In particular, multicriteria analysis is an adaptation of Morris Hill's (1968) goals-achievement matrix. An application of Hill's method is illustrated by Miller (1980). For in-depth treatments of multicriteria methods, see Voogd (1983) and Faludi and Voogd (1985).

While multicriteria methods are well known in the field of urban planning, apparently they are little known, or at least not often used, in the field of higher education. This conclusion is based on the fact that a computer-assisted search of the U.S. Department of Education's bibliographic data base--Educational Resources Information Center (ERIC)--revealed no applications of multicriteria methods of the type we used. Our method appears, however, to embody the concept of multiple-perspective evaluation described by Palola and Bradley (1976) in a paper discovered in our

search of ERIC. That is, the multicriteria method we used, in effect, allowed the selection of a student-information system to be considered from multiple perspectives. This occurred because the concerns of all interested parties were translated into one or more of the criteria that appear on the evaluation form.

In using multicriteria analysis, if a particular concern is not represented by one of the criteria, its absence will likely jump out at the people who have the concern. They can then request that appropriate criteria be added to take their concern into account. Likewise, if a group feels that particular criteria have been given insufficient weight, or too much weight, weights can be changed. (There is no theoretical limit on the magnitude of a weight.) Adjustments to criteria and weights happen easily and naturally as people are asked to review drafts of the evaluation form. In this sense, the use of the method is self correcting.

The value of using many criteria lies in the fact that when all the concerns are "on the table," no one of them, no matter how important to a particular group, is likely to be given undue weight in the final decision. This characteristic of multicriteria analysis can eliminate resistance to change on the part of a group that is dissatisfied with one or a few features of an alternative: When members of the objecting group are given a way of viewing the alternative from the perspective of all the criteria, they may decide it is the preferable choice after all. In this case, one group of users had decided that the existing HP system was preferable to either of the ISIS alternatives. When, however, their

concerns were taken into account explicitly in the form of criteria and weights, along with many other concerns, they accepted ISIS with all modifications.

## Conclusion

Multicriteria analysis, used in the way we have described, forces interested parties to advocate their concerns in light of everyone else's concerns. The process we used allowed the parties to see the decision from multiple perspectives and move to consensus. While we do not claim this will always occur, the outcome in this case suggests that multicriteria analysis can, at the very least, facilitate movement toward consensus.

We found multicriteria analysis to be a useful, easily understood tool for managing large amounts of information. Based on our experience with and knowledge of the tool, we feel it can, and should, be adapted to different kinds of decisions and decision-making processes encountered by institutional researchers.

## References

Faludi, Andreas and Voogd, Henk, eds. (1985). Evaluation of complex policy problems. Delft: Delftsche Vitgevers Mastschappij.

Hill, Morris (1968). A goals-achievement matrix for evaluating alternative plans. Journal of the American Institute of Planners 34(1):19-28.

Miller, Donald H. (1980). Project location analysis using the goals-achievement method of evaluation. Journal of the American Planning Association 46(2): 195-208.

Palola, Ernest G. and Bradley, A. Paul Jr. (1976). Multiple perspectives evaluation: a strategy for dealing with conflict pressures. Unpublished paper presented at AIR Forum, May. Available in microfiche as ERIC # ED 126842.

Voogd, Henk (1983). Multicriteria evaluation for urban and regional planning. London: Pion Limited.